that it is moving towards an end without clearly and fully apprehending what that end is. And when we have once grasped the possibility of this pseudo-purposive action, we are tempted to generalise it, and deny intelligent purpose in all cases." So the primitive mind is guided by feelings and impulses which it cannot fully understand, and observers may be misled so far as to assert that this or that tribe is destitute of all conception of right and wrong. From the beginning man has been bound by moral law, and the author finds, throughout, "a recurrence of the common features of ordinary morality, which is not less impressive than the variations." Yet, while "ethical progress is essentially a progress in ethical conceptions, acting through tradition," the question whether, "morally considered, the human breed has in fact improved" is difficult to settle. Here the researches of Freud into the nature of the "unconscious mind" would be in point, but "Morals in Evolution" is mainly a study in morphology. As such it is invaluable.

(2) Hegel argued that the State is the realised ethical idea. It is interesting that Hegel commenced the sequence of ideas of which Treitschke was the most spectacular exponent. Prof. Ford, of Princeton, has made "a detailed survey of connections between biology and politics inferable from the doctrine of Darwinism." He concludes that "the fundamental difference between Man and other mammalia is that he is distinctly a product of social evolution." "Man," as Profs. Geddes and Thomson have observed, "did not make society; society made Man"; "the individual," says Prof. Baldwin, "is the result of refined processes of social differentiation." Prof. Ford's book seems to be a series of lectures, based on appropriate quotations in biology, psychology, and linguistics, to contradict the theory of "individual evolution" so called. The State, as Aristotle said, is prior to the individual; language and social psychoses have helped to make the individual mind. There is a well-defined series of stages in the social organic evolution; phylogenetic theory passes into political science. The evolution of the State and the evolution of the individual mind are two aspects of one process, which starts from the human genius for social life. The chief interest of this view is in the relation between man's biology and psychology, and here the advocates of what Prof. Ford styles "the Social Hypothesis" have to assume a "psychological chasm" between man and the primates. Thus, if man's peculiar development of intelligence accounts for the beginings of a social evolution superior to others, and if his peculiar intelligence is only to be explained by the action of his social evolution, there is a circular argument at the very starting-point of the hypothesis.

(3) In his preface to Miss Hughes's volume Prof. J. H. Muirhead observes that the war will pass judgment on two ideals of education, which are intimately bound up with the theory of the State and with the practice of government and citizenship. In the one there is "the disinterested development of the powers of the individual, to the end of giving him his place in a community of free and equal citizens with an outlook beyond to a world-order of like communities." In the other there is a community "narrowed down to a particular nation and state, carrying with it the regimentation of powers and the subordination of will to the end of its own particular purpose of racial predominance." Miss Hughes argues that the "root causes and the root cures of social evils are educational rather than economic," and she pleads for more of the humanist ideal in our educational system. Our elementary education has been adversely criticised; the author succeeds in pointing out its real merits and in proving many good results it has had upon our citizenship. The problem of the school is the problem of the nation, as the Greeks realised long ago. This enthusiastic teacher perhaps asks too much of the average mentality of the people, but not the least merit of her book is the wealth of practical suggestions which deserve the attention of all interested in education, since they are evidently inspired by a high idealism and based upon personal experience. A. E. CRAWLEY.

CHEMISTRY AND THE MICROSCOPE.

Elementary Chemical Microscopy. By Prof. E. M. Chamot. Pp. xiii+410. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1915.) 12*s*. 6*d*. net.

THIS book forms a welcome addition to the very restricted literature of chemical microscopy. It affords a considerable amount of information concerning the microscope itself, and its special adaptation to the purposes of the chemist and metallurgist. It also places at the disposal of the chemist the data for performing a large number of more or less trustworthy microchemical reactions. One notices immediately, however, a singular omission, that of any reproductions of either drawings or photomicrographs of the crystals produced in these reactions as observed under the microscope. A book on microchemical analysis without any indications other than verbal of the appearances seen under the microscope is surely like the play of "Ham-

© 1915 Nature Publishing Group

let" without the title-rôle. Considering the excellent photomicrographical apparatus now available such an omission is not easy to understand. More than twenty years ago the reviewer prepared and showed to his students in the form of lantern slides numerous photomicrographs of the crystalline products of chemical reactions. The book of Haushofer (which does not appear to be mentioned at all by Prof. Chamot), published so long ago as 1885, although faulty in many respects, contained a large number of reproductions of careful drawings of the appearances on the microslip, and the later work of Behrens was also well illustrated in a similar manner.

Another defect obvious to British readers is the very slight mention of, or even complete omission of any reference to, much of the important work achieved by British workers in this domain, especially as regards instruments. For instance, the splendid crystallographic microscopes constructed in London by Swift are ignored, although, after using almost all the Continental microscopes, the reviewer considers no instrument can compare for efficiency or elegance with the later forms of the Dick microscope as made by Swift. Such omissions, however, are not at all uncommon in the recent books and memoirs of United States authors. For example, Prof. F. E. Wright, in a recent memoir on "A New Crystal-grinding Goniometer," an instrument for preparing accurately orientated surfaces on crystals, while making considerable reference to very inferior German apparatus, merely makes a footnote reference to the refined, rigidly stable, very efficient, and much more complete instrument for this purpose constructed long ago by Messrs. Troughton and Simms for the reviewer, and with which the thousands of section-plates and prisms have been prepared for his prolonged work on the sulphates and selenates and numerous double salts. Perhaps the lessons of the war will enable our cousins in the United States to appreciate more fully the important pioneer work in science done in this country, and to be less ready to accept the much more widely advertised German work as being alone worthy of consideration.

When such defects as have been referred to are discounted, a very valuable aid to chemical microscopy will be afforded by Prof. Chamot's book. One of the most interesting chapters is one on ultra-microscopes. It is shown that the ultra-microscope renders visible particles so minute that their diameters may be only slightly greater than the half-wave-length of the light employed, on the principle of the "Tyndall effect," that which is evident in the dust scintillations (diffractions) of a beam of light passing through an orifice into a darkened room. Good illustrations and explanations are given of the Cotton and Mouton, Cardioid, and Zsigmondy ultra-microscopes, the Jentsch ultra-condenser, and the slit ultra-microscope. There is, moreover, a good chapter on the determination of index of refraction by means of the microscope, and also one on attempts at quantitative analysis by the same instrument, including an account of the Barger method of determining molecular weights by micrometric measurement.

The small amount of crystallography, about a dozen pages, is both antiquated and not always accurate; no student could possibly obtain a true idea of the subject without previous or further study. In the preface Prof. Chamot states that his book is intended for students who have passed through a course in crystallography. If there should be many such happy students in the United States they are much more fortunate than their British cousins. Indeed this book only adds one more to the many examples for the very urgent need, both in America and in this country, for the provision of efficient instruction in a subject which is now an essential one to the correct understanding of either chemistry, physics, metallurgy, or any of their many specialised ramifications.

A. E. H. TUTTON.

MATHEMATICAL THEORY AND PHYSICS.

(1) *The Mathematical Analysis of Electrical and Optical Wave-Motion on the Basis of Maxwell's Equations.* By Dr. H. Bateman. Pp. vi + 159. (Cambridge: At the University Press, 1915.) Price 7*s.* 6*d.* net.

(2) *Homogeneous Linear Substitutions.* By Prof. H. Hilton. Pp. 184. (Oxford: At the Clarendon Press, 1914.) Price 12*s.* 6*d.* net.

ORIGINAL, and in fact fundamental, work in mathematics proceeds very rapidly in these days, and in so many departments, that even the expert mathematician frequently complains that it is impossible to keep pace with any but a restricted field. In these circumstances, we can well imagine the position of the unfortunate student who wishes to do mathematical work of a post-graduate nature, and even knows where his inclinations lie, but is appalled by the difficulty of discovering the present condition of any branch of the subject. There is room at present for many volumes which shall fulfil one or more of three main functions—collect together the fragments of a fundamentally important body of theory from their hiding-places in periodicals and text-books on other subjects, give the student exhaustive references to and criti-

© 1915 Nature Publishing Group